CHAPTER - IV

CORAL REEFS IN LAKSHADWEEP - THEIR STATUS AND MANAGEMENT

INTRODUCTION

Of all marine ecosystems, coral reefs have the highest productivity and sustain heaviest human use (Wells, 1989). The "International Union for Conservation of Nature and Natural Resources" identified coral reefs as one of the essential life supporting systems, necessary for human surviavol and sustainable development (IUCN/UNEP/WWF, 1980). Research on reefs have shown in the 1960s and early 1970s that they are fragile and delicate ecosystems, extremely vulnerable to human activities, and slow in recovery if damaged (Johannes, 1975). Many of the world coral reefs are under the threat of natural and manmade damages. Lakshadweep coral reefs are no exception to this (Pillai, 1983, 1985; 1986; Wafar, 1986; James et al., 1989). The atoll environment in general is a relatively restricted ecosystem, where the impact of natural as well as manmade assaults will manifest heavily within short span of time. Realising the urgent necessity for the protection of this ecosystem, attempts have been made during the present study through prolonged observations, to evaluate the present status of the coral reefs and to locate the sources of damage in some of these islands. In the light of these, suggestions are made for the management and conservation of this ecosystem.

PRESENT STATUS OF THE CORAL REEFS OF LAKSHADWEEP

Lakshadweep Atolls are famous for their rich resources and flourishing reef fauna, but the threat of deterioration from various forces are gripping almost all the atolls of this area. At present healthy and untouched fauna exist only in those islands which are not inhabited by man, like Suheli and Bangaram. There are good growth of corals and associated fauna in some isolated areas in the human inhabited islands like Kalpeni, Agatti and Chetlat also, but the coverage is patchy and localized to deeper
areas which are beyond the easy reach of man. This gives an impression that the major cause of reef deterioration at Lakshadweep is related to human activities. Developed islands like Kavaratti, Minicoy (Pillai, 1983) and Agathi are the worst affected areas.

Bangaram and Suheli islands have vast, spacious lagoons, surrounded by well defined and strong reef frame. These islands are not permanently inhabited by man, which coupled with the deep lagoon and healthy reef frame provide calm environment, supporting growth of rich reef fauna and flora. Ramose and tabular acroporid corals exist in deeper areas of the lagoon, the shallower areas are dominated by massive Porites, Goniopora and Heliopora genera. Bangaram lagoon has several coral knolls rising from deep bottom, around which exists good growth of corals. In general the life in Bangaram and Suheli lagoons look healthy and harbour thick assemblage of reef fauna. Mild erosional effects were observed in these islands, especially in Suheli, however, these did not look serious.

Kalpeni lagoon harbours rich growth of corals and associated fauna at the central and northern areas where the lagoon is deep and to some extent protected from excessive human use. Near 'Cheriyan' and 'Kodithala' islets thick assemblage of coral exists, which seemed untouched by man. This area is dominated by ramose Acroporid corals. Tabular Acropora species are rich in the deeper areas, some of them have grown even to a diameter of 1 m. Shallow areas toward the beach have profuse growth of Acropora aspera. Toward the reef, the lagoon is dominated by massive Porites and Heliopora corals. But the shallower southern area of the lagoon is practically denuded of live coral cover and associated organisms. A major portion of this area gets exposed during low tides, and receive excessive human activity. Erosional elements are severe in this island. Some of the small islets at the southern end of the main island are shrinking due to large scale erosion (Plate 9a). According to local people, one islet (Tilakam) has already disappeared in erosion. Erosion is rampant on the main island also, where loss of coconut palms and land property was observed (Plate 9b).
The lagoon of Kavaratti gives a denuded look. Reasonable growth of corals is restricted only to the southernmost tip of the lagoon. This area is dominated by branching Acropora and Porites forms, intermixed by large massive Porites and Heliopora corals. The central and northern areas of the lagoon have only isolated colonies of massive species. The lagoon has, toward the beach, all along the length, a luxurient growth of seagrasses. At the lagoon entrance, all the coral structures are dead and covered with sediment and debris. Excessive colonization of hard rocky reef substratum with filamentous green algae was observed in the present study. This is spreading all along the lagoon at an alarming rate, which could prevent new settlement and growth of corals. Cyclic beach displacement was observed at the northern tip of the lagoon with seasonal change in wave direction. Land erosion is severe in this island, which is more on the seaward side of the island. At the northern tip of the island, even the seawall has been broken in wave action, and the whole beach is getting eroded (Plate 9c).

Amini Island has a very shallow lagoon. During low tides, a major portion of the lagoon gets exposed. All along the lagoon, isolated branching Acropora coral colonies are observed. The dominant forms are Porites. Shallow intertidal areas of the lagoon is characterised by thick growth of seagrasses. Toward the northern side of the lagoon there is good growth of corals, mainly massive forms. The lagoon flat looks heavily sedimented, and gives an impression that the lagoon is fast getting filled up. The seaward side of the island is subjected to heavy land erosion. (Plate 9d). Continuous dredging has been reported from this island (James et al., 1989).

Kadmat Island is long and narrow, having a vast lagoon with many coral shoals, but most of which are dead and live coral cover is less. Coral growth in the lagoon bottom looked rich, with ramose Acropora, Porites and massive forms. The inner reef flat and lagoon flat harbour rich assemblage of life and the lagoon in general gives a rich appearance. Northern half of the lagoon is richer in reef life than the southern half.
The seaward side of this island is facing the threat of erosion, but comparatively lesser in magnitude.

A rich coral and reef associated fauna exist in the lagoon of Chetlat Island. The northern areas get exposed during low tides, and live coral coverage is less, but toward the deeper areas good growth of corals exists. Acropora, Porites and Heliopora are the dominant forms. Profuse distribution of smaller forms like Psammocora was observed in the lagoon flat, and reef flat. In general the lagoon harbours a fairly good assemblage of corals. Beach erosion and filling up of the lagoon with sediments and excessive sediment depositions were visible in many areas. Human activities in the lagoon and removal of corals are less in this island.

Agatti being a fast developing island, the increased interference on the ecosystem is well reflected on the present status of the reef. This island has fairly good growth of corals at the central and southern areas of the lagoon. Lagoon bottom toward the beach has thick growth of seagrasses. Northern area of the lagoon is characterised by massive and encrusting forms, but most of these are dead and colonized by algae. Excessive colonisation of the reef substratum with a green filamentous algae was observed in this island also. Central and southern areas of the reef and lagoon flat harbour good growth of corals. Human activity in the lagoon is very high, especially during low tides. Erosion is rampant in this island. At many places, coconut palms and vast areas of land have been lost in erosion (Plate 9e). The northern end where the lagoon entrance is situated, faces severe cyclic beach displacement and land loss.

CAUSES OF DAMAGE

Causes of damage and deterioration of coral and coral reefs at Lakshadweep are many. It is impossible of single out any one particular reason, but because of a combination of various natural and man made causes.
Natural damage

At present natural damage due to biological agents are not in a noticable scale. The notorious "crown of thorns" starfish *Acanthaster planci*, which devastated many world coral reefs (Glynn, 1973; Endean, 1973; Seymour, 1989; Wilkinsen, 1990) has been reported from Lakshadweep, in Minicoy Atoll (Murty et al., 1979) and in Kavaratti Atoll (Sivadas, 1977). The present study recorded this species from Kalpeni Atoll (Plate 9f). Though their actual population density is not known, it appeared that they are not in any dangerous scale.

It was observed in the present study that in many of these islands the rocky substratum is getting covered with a filamentous green algae, which is excessive in Kavaratti and Agatti lagoons. Bio-fouling and bio-erosion of live and dead corals have been reported from Lakshadweep, but no specified study has so far been made on these aspects, except for the works of Appukuttan (1973) on oral boring bivalves and Thomas (1988) on boring sponges. Destruction due to natural calamities at Lakshadweep has been documented by Jones (1986). As described earlier, erosion is a menace in the present day Lakshadweep. Though the process is natural, the major cause is man's modification of the environment, which can be effectively prevented.

Human interferences

At Lakshadweep, human interferences pose more serious threat than natural forces. Major problem is from the removal of live corals. Though this has been banned, the process is on the increase. The removal is mainly by visitors and local people themselves. Local people sell cleaned corals to tourists and visitors or present to guests as souvenirs. Tourists and visitors do their best to take atleast a small bit of coral with them. The process is severe in Kavaratti, Minicoy, Agatti and Kadmat islands. In Kavaratti atleast 4 families are involved in clandestine selling of cleaned corals to tourists and visitors. Branching *Acropora*, *Pocillopora* and solitry coral like *Fungia* are the most exploited forms.
PLATE 9.

a. Shrinking islet at the southern area of Kalpeni lagoon.

b. Loss of land due to wave action and erosion at the main island of Kalpeni.

c. Broken sea wall and disappearing beech at the northern tip of Kavaratti Island.

d. Seaward side of Amini Island exposed to strong wave action.

e. Loss of land and coconut palms at Agathi Island due to erosion.

f. Acanthaster planci, recorded from Kalpeni lagoon.
During the lowest low tides, when the reefs get exposed, they undergo heavy trampling by people. Fishing, octopus hunting, shell picking and walking on the exposed areas of coral cover cause extensive breakage and destruction. These processes are more in islands like Kavaratti and Agatti, where there are always large number of visitors. Pressure of exploitation on ornamental shells like Cypraea, Lambis, Conus, Turbo etc. is very high, that many of them are becoming rare.

Lagoon based fishing activity using large nets and rope lines cause excessive damage to branching forms. Fishermen in the fishing frenzy pock and beat on corals with spears and sticks which cause severe damage. In shallow areas the activity stirs up settled sediment and cause resuspension. Mooring and anchoring of fishing boats and cruising in shallow areas of coral cover also cause considerable damage.

Localized removal of coral boulders from the reef and beach results in large scale erosion of shore line and land property. This is severe in Kavaratti, Kalpeni and Agatti islands. The removal is mainly for the construction of houses, buildings and compound walls (Plate 10a). The increasing population density and the way of living as independent families demand construction of more and more houses and compound walls. The removal of coral rocks for making lime and collecting coral shingles for making concrete, by people and administrative departments are also on the increase. All these processes expose large areas of land to savage waves resulting in erosion, which create sedimentation in water, destroying vast areas of coral life (Plate 10e,f). Removal of coral boulders from the reef, which otherwise have been forming an effective barrier to heavy waves, results in large scale disappearance of land, as seen in Kavaratti, Kalpeni and Agatti Islands.

Dredging and deepening of boat channels and jetty have been reported from Lakshadweep since very long time. It is still in practice in Kavaratti, Agatti, and Amini Islands. Cutting and deepening of reef to facilitate boat entry into the lagoon allows waves to pound on the land,
which is the cause for the cyclic beach movement in Kavaratti and Agatti Islands. Kavaratti, island is facing severe threat from deepening of jetty (Plate 10b). Vast areas of seagrass beds and lagoon substratum have already been dredged. The deleterious effects of dredging of coral reefs have been summarised by Rogers (1990). Pillai (1983) reported that the large scale killing of corals in Minicoy was due to the effect of dredging and sedimentation. Good coral cover support multitude of other organisms, especially the valuable fishes (Plate 10c, d). Death and destruction of live coral force these associated fauna to move away or die, making the environment barren and invite algal colonisation (Plate 10e, f).

The problems of pollution in Lakshadweep have been dealt with by James et al. (1989). At present the major source of pollution is by oil. The increasing number of mechanised fishing boats and large vessels pose threat in the near future, because all these vessels are anchored in the lagoon. Aged engine oil and diesel waste are dumped on the lagoon beach. All these cause localised oil spill. During lowtides these pollutants get deposited on seagrasses and corals. This was observed in Agatti and Kavaratti lagoons.

Construction of an airstrip at Agatti Island resulted in large scale destruction of reef life, when the slaughtered coconut palm trunks and stumps were dumped into the lagoon. This crumpled many coral colonies at the southern tip of the lagoon (local people, personal communication). The candidate personally observed palm stumps entangled among coral formations.

**MANAGEMENT ASPECTS AND RECOMMENDATIONS**

Research has shown that reefs can regenerate, but the time scale, the mechanism involved and the extent to which new reef will resemble the old one are still poorly understood (Wells, 1989). Hence it is extremely difficult to suggest control measures, and reef management tend to be largely a matter of common sense (Wells, 1989) dependent on the local conditions.
PLATE 10.

a. Coral stones used for the construction of compound wall at Kavaratti.

b. Dredger and dredged material filled in the barge.

c,d. Thick growth of corals in deeper areas with the assemblage of fishes.

e,f. Mass mortality of corals due to excessive sedimentation.
The present observations could bring forth only a qualitative picture of the damage occured, but a more deep and quantitative study to assess the magnitude of damage is an urgent necessity before formulating any protective measures. This requires a team of specialized personnel. Since the islands are just specks of land surrounded by high seas, and their very existence depends on the continuous growth and maintenance of calcareous organisms, mainly corals, something has to be done immediately.

Realising the urgency for protecting these islands, the following suggestions are made.

1. Removal of live corals may be prevented through strict implementation of the already existing rules. The existing ban on this is largely overlooked, and seemingly there is no interest from the authorities to strictly impose the regulations. People are unaware of the ban or the delicateness of the system. Hence these should be informed properly to people, and visitors who seek entry into this territory. Tourist activity must be strictly managed by trained guides who can brief them of the vulnerability of the environment. Distributing pamphlets and erecting notice boards, large enough to be noticed by visitors, would be of great benefit.

2. Social and economic development is a must for all society, but in such societies where land and resources are limited as in Lakshadweep, the developmental activities should be properly controlled to keep pace and harmony with nature. The existing practice of removing coral rocks for housing should be controlled by providing the people with burned bricks and granite stones at subsidised rates through government bodies.

3. Fishing activity in the lagoon should be properly managed. Using large nets and cruising boats in shallow areas of coral cover should be banned. The lagoon based capture fishery could be modified by the introduction of culture and farming by designing suitable methods which will not interfere in the ecosystem.
4. Dredging should be completely stopped. Proper sea-walls and barriers should be erected in areas of erosion and cyclic beach movement.

5. Creation of marine park and sanctuaries would provide protection from direct assault on reef fauna and environment. Detailed suggestions in this line have been made by James and Pillai (1989). Any motion for the creation of marine parks should be properly negotiated with fishermen. Suheli, Bangaram and some areas of Kalpeni Atoll have the potential to be declared as marine parks. Establishment of 'artificial reefs' in denuded areas of the lagoons can attract fishes and other reef fauna into the lagoon.

6. Research and studies on the elements which deteriorate the system, and socioeconomic problems that directly or indirectly interfere with environment, should be activated.

7. Educating people about the urgent need for population control in this tiny territory, benefits of family planning and imparting training to local volunteers for managing the environment would generate good results towards conservation of coral reefs in the long run. Formal education for island children from lower school levels and informal education for youth and adults about the need for conservation can make drastic signs of awareness about the delicateness and fragility of this coral habitat.

Conservation and management of this area is not easy, specially because the main-stay of people lies in the coral habitat. So the management measures should come from a greater public awareness, and integrated wide-ranging conservational policies, a difficult, but not an impossible one.